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U.S. Forest Service
Region 6

Working Plan
Mountain Pine Beetle Loss Assessment Survey on Lodgepole Pine Stands Wallowa-Whitman National Forest

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
Region 6
P.O.Box 3623,Portland,Oregon 97208

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REPLY TO: 3400 Forest Insect and Disease Management December 21, 1979

SUBJECT: Work Plan on Mountain Pine Beetle Loss Assessment - Wallowa-Whitman NF

TO: PSW

The attached work plan on mountain pine beetle loss assessment on the Wallowa-Whitman National Forest is an active R-6 FIDM Program. Although field work for stand examination plots and supplementary mountain pine beetle plots in each stand is under private contract, completion of acceptable survey work is far below expectations. The survey will not be completed until mid 1980. The need for quality control on loss assessment surveys cannot be over emphasized.

The details provided in this work plan should help provide background for anyone considering similar loss assessment surveys.

Paul E. Buffam

PAUL E. BUFFAM, Director
Forest Insect and Disease Management

Enclosure

1 copy Rec'd 12/26

U.S. Forest Service
Region 6
Working Plan
Mountain Pine Beetle Loss Assessment
Survey on Lodgepole Pine Stands
Wallowa-Whitman National Forest

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Introduction

A wide range of mountain pine beetle activity has been occurring in lodgepole pine stands of the Wallowa-Whitman and Umatilla National Forests in eastern Oregon and Washington.

Since 1969, some 1.7 million acres of lodgepole pine have sustained an estimated 976.4 million board feet of tree mortality. The impact of such tremendous losses on existing and future forest management plans, recreation site development, range and wildlife management, water and soil regimes, and fuels and fire management is of great concern to land managers. The losses caused by the mountain pine beetle can best be measured by a loss assessment survey in lodgepole pine stands.

This survey is designed to provide forest managers with information on the actual losses and potential losses to be expected in similar stand conditions on other forests in the Pacific Northwest Region. The following plan details the procedures for collecting and analyzing loss assessment and stand examination data to accomplish this purpose.

Objectives

The broad scope of this survey project is to provide estimates of potential MPB losses in lodgepole pine stands within the Pacific Northwest Region.

Principal objectives are to:

1. Determine from standard Pacific Northwest Region stand examination data collected from lodgepole pine stands where the mountain pine beetle has been active, the average number of trees per acre, basal area per acre, and volume per acre for residual green and dead components within each stand.

2. Simulate the mountain pine beetle outbreak from the same stand examination data (back dated to the pre-outbreak condition of all green trees) using the stand prognosis model (Stage).

3. Determine the feasibility of using the stand prognosis model in the Pacific Northwest Region to simulate mountain pine beetle outbreaks by comparing the results of simulation with actual loss assessments.

Delineating Survey Area

The annual regionwide aerial surveys by Forest Insect and Disease Management, Pacific Northwest Region, delineate the broad boundaries of forest insect activity in Oregon and Washington. Approximately 467,000 acres of a total of 800,000 acres of lodgepole pine on the Wallowa-Whitman National Forest have been delineated as heavily damaged by mountain pine beetle in 1978 (Appendix, Table 1). Similar losses are occurring on the Umatilla National Forest (Appendix, Table 2), but because stand examination data is unavailable on this Forest at this time, the loss assessment survey will be limited to the Wallowa-Whitman National Forest. Ground surveys will be made on stands of the Baker, LaGrande, and Chesnimnus Districts.

Stand Selection

A combination of several methods will be used to select and sample lodgepole pine stands. Estimates of MPB losses and residual trees will be distributed over three strata of the lodgepole pine type.

The delineations of the lodgepole pine type and the selection of stands in each of three strata to be sampled consists of three phases: (1) transferring lodgepole pine stand data from the on-going Wallowa-Whitman stand examination project (interpretations from 1977 resource color photography at 1:15,840 scale) to 4-inch-to-the-mile sectionized TRI ortho maps, (2) making an aerial reconnaissance using TRI maps of the three districts to identify stands in each of three strata (updating bark beetle distribution since the 1977 color photography in each stand), and (3) transferring stands to be sampled to 1:15,840 scale color prints and sectionized ortho photo quadrangle maps (2.6 inches per mile).

Phase 1

All timber types and ecoclasses of the Wallowa-Whitman National Forest have been delineated by photo interpretation by a special forest resource interpretation group using 1977 aerial color photography. Stand boundaries to a 10-acre minimum were outlined on the 1:15,840 scale photos. Ground examinations of many stand types are being made. All stand boundaries are being transferred from the resource photos into the TRI (Total Resource Inventory) system on 4-inch to-the-mile ortho photo compartments. Although completion of this transfer operation is not anticipated until September 30, extra scribers have been secured to complete the LaGrande and Baker Districts by June 30.

On each compartment ortho photograph the stands containing lodgepole pine as a significant component are digitized and planimetered to establish ground sampling criteria (spacing and determining numbers of plots). The boundaries of lodgepole pine stands are color scribed and acreage annotated. These ortho photos (4-inch to-the-mile) are the base maps for delineating from the air in Phase 2.

Phase II.

By aerial reconnaissance the 14 townships on the Baker and LaGrande Districts and 4 townships on the Chesmimnus District will be inspected and the lodgepole pine type in each compartment classified into one of three strata; (1) green lodgepole pine stands (70% or more second growth or mature lodgepole pine and 30% other species with no visible beetle activity,) (2) active mountain pine beetle (MPB) infestations in lodgepole pine stands, and (3) stands where the MPB has run its course leaving dead lodgepole pine groups. The aerial reconnaissance will help to update the bark beetle situation since 1977 for improved lodgepole pine stratum classification.

Lodgepole pine stands in each strata will be numbered consecutively in all compartments starting with northwesterly compartments, then east, and then proceeding southward on the two Districts. Approximately 30 stands will be selected from each strata by systematic random selection (random start and systematic distribution for needed plot total). It is believed that accessibility will not be a major problem. However, study of the stand distribution pattern may reveal the need for a two stage stratification based on accessibility. Because of operational efficiency, stands to be ground sampled will not be more than 1 mile from an existing road unless there are less than 20 stands for each strata.

Phase III

Stands categorized by strata from aerial reconnaissance were color coded on the TRI compartment ortho photographic base maps which cover 6 to 10 square miles (4-inch to the mile). The systematic random sample of selected stands to be ground sampled will be transferred to the 2.6 inches to-the-mile ortho photo quadrangle sheets using a Bausch and Lombe transfer scope. These quadrangle sheets will be used in planning and implementing various ground survey phases of the MPB loss assessment survey (covers a township). In addition, the stand boundaries will be transferred to the 1:15,840 color prints for field use by the two-person survey teams.

Data Collection

Variable plot cruising is appropriate for this loss assessment survey. Basic stand examination field procedures for Oregon and Washington as described in the Pacific Northwest Region supplement of the Forest Service Handbook (42.1-42.2) will be followed with some minor procedural variations depending upon local conditions. The Wallowa-Whitman National Forest uses a primary sampling frame of a systematic grid with sampling points distributed according to stand size, relative shapes, and geographic constraints. As stand size increases, grid spacing increases from 4 to 8 chains between stand examination points. An acceptable grid spacing for each stand is based on obtaining an average 20 percent sampling error. The grid spacing for each stand selected for sampling will be predetermined in the survey contract. Stand examination and MPB loss assessment data will be collected from some 90 stands ranging in size from 10 to 560 acres.

It is estimated that the sporadic and random distribution of bark beetle killed trees will require two additional sample points between each stand examination point to maintain a 20 percent precision level. Complete stand examination data would not be taken at these MPB supplemental survey points. Stands with active MPB infestations (Strata 2) and stands where MPB outbreaks have run their course (Strata 3) will have supplemental sample plots. The homogeneity of green lodgepole stands requires standard distribution of stand examination points but no supplementary MPB plots.

At each stand examination point and supplemental point both a #10 B.A.F. prism and a 1/100 acre (11.8 feet radius) fixed area plots will be used. A comprehensive explanation of the general and technical specifications are described in the Appendix ( ).

Data Analysis

Data will be analyzed for stands by using Al Stage's MPB outbreak version of the Stand Prognosis Model, and by a Pacific Northwest Region FIDM variable photo cruise program V plot, and the Pacific Northwest Region stand exam program at FCCC. Data will be processed separately for each stand (as an independent management unit) using standard variable plot cruising analysis techniques. These analyses will provide stand tables of number of trees per acre, basal area (BA) per acre, and stand volumes for various tree condition classes.

A diagram of the data analysis between the output from the Stand Prognosis Model and the actual MPB loss data in lodgepole pine stands is shown next. Standard statistical analysis using t-Test for paired plots will be used to determine if differences among the two methods exist. The normal statistical test "t" will be tested at the .01 and .05 probability level, P = .68.

Stratum	Stand No. (PSU)	Mean Growth/MPB Loss Per Stand		
		Simulated[1/]	Measured[2/]	Difference
1 (Green)	1	S_{11}	M_{11}	D_{11}
	2	S_{12}	M_{12}	D_{12}
	⋮	⋮	⋮	⋮
	g	S_{1g}	M_{1g}	D_{1g}
	(Means)	$S_{1.}$	$M_{1.}$	$D_{1.}$
2 (Red)	1	S_{21}	M_{21}	D_{21}
	2	S_{22}	M_{22}	D_{22}
	⋮	⋮	⋮	⋮
	r	S_{2r}	M_{2r}	D_{2r}
	(Means)	$S_{2.}$	$M_{2.}$	$D_{2.}$
3 (Dead)	1	S_{31}	M_{31}	D_{31}
	2	S_{32}	M_{32}	D_{32}
	⋮	⋮	⋮	⋮
	d	S_{3d}	M_{3d}	D_{3d}
	(Means)	$S_{3.}$	$M_{3.}$	$D_{3.}$
(Grand Means)		$S_{..}$	$M_{..}$	$D_{..}$

1/ Output from Stand Prognosis/MPB Outbreak Models.

2/ Output from Stand Examination Programs.

PSU - primary sampling unit
S - simulated plot
M - measured plot
D - difference between S and M

Timetable of Activities

A.	Phase I. Wallowa-Whitman stand exam by photo interpretation of 1:15,840 scale color	June 1
	Transfer stand compartments to TRI base (4 inch per mile maps) of three survey districts	June 30
	Transfer lodgepole pine stands to ortho-photo base maps (TRI)	July 6
B.	Phase II. Special aerial reconnaissance of the LaGrande, Chesnimnus, and Baker District	July 23
	Select stands in each stratum, determine grids, prepare maps and photos for ground survey	August 3
C.	Phase III. Transfer selected stands from TRI base to quadrangle ortho-photo base	August 10
D.	Prepare specifications for contract survey	August 20
E.	Issue stand exam and MPB survey bid	August 24
F.	Award survey contract	September 17
G.	Pre-survey meeting with contractor	September 24
H.	Ground survey	
	Field plot technique check	June 10
	Field crew orientation	September 25
	Field operations	November 10
I.	Data compilation	December 14
J.	Data analysis	February 15
K.	Report preparation	
	Review draft	May 15
	Final report	June 15

APPENDIX

Historical Background

Ground and annual regionwide aerial surveys in Oregon and Washington delineate the general distribution and amount of mountain pine beetle-killed trees in forest stands. The Forests use this broad base information to develop management strategies and help orient salvage operations. Frequently, special aerial assessment surveys are made by the Forest to further refine the broad-base survey maps.

Historically in the Wallowa-Whitman and Umatilla National Forests, considerable mountain pine beetle damage has been recorded. A summary (1969-1977) of the losses by each Forest indicates how serious the problem has become (Tables 1 and 2).

Table 1.--Mountain Pine Beetle in Lodgepole Pine and Ponderosa Pine, Wallowa-Whitman National Forest

Year	Acres		Volume (MBF)	
	Lodgepole Pine	Ponderosa Pine	Lodgepole Pine	Ponderosa Pine
1969	13,570	11,870	5,021	915
1970	53,580	34,010	285,935	4,820
1971	84,680	19,680	30,050	1,695
1972	96,380	11,540	24,820	450
1973	99,980	14,270	18,570	1,195
1974	229,340	34,260	52,160	2,430
1975	478,290	136,880	84,280	7,040
1976	514,240	394,410	63,840	20,300
1977	403,440	810,580	69,650	186,430
1978	467,000	364,120	48,120	116,455

Table 2.--Mountain Pine Beetle in Lodgepole Pine and Ponderosa Pine, Umatilla National Forest

Year	Acres		Volume (MBF)	
	Lodgepole Pine	Ponderosa Pine	Lodgepole Pine	Ponderosa Pine
1969	5,980	5,980	3,100	310
1970	11,340	3,600	122,620	150
1971	16,500	2,340	5,785	20
1972	14,090	1,040	2,190	45
1973	50,060	4,790	7,135	125
1974	110,710	3,340	14,790	100
1975	287,920	17,760	41,585	485
1976	341,750	109,150	48,340	3,880
1977	369,490	99,320	78,920	40,820
1978	360,100	103,050	37,880	20,035

DIVISION 100 - GENERAL SPECIFICATIONS

110 Scope of Contract

111 It is the purpose and intent of this solicitation to secure timber stand examination survey on approximately 8,840 acres gross area. The cruise is to be done by measuring approximately 4,950 stand examination plots distributed throughout the area. Plot spacing will vary dependent upon size and shape of each stand. The Contractor may vary the plot spacing and/or transect orientation + or - 10% if needed to obtain the required number of plots for each stand.

112 The contract work areas are shown on the attached vicinity map. Aerial photographs of the project area are available for inspection at the Wallowa-Whitman National Forest Headquarters, Baker, Oregon.

120 Location and Description

121 Project Location

The project work areas are located on the Wallowa-Whitman National Forest.

122 Accessibility

The project area may be reached by forest roads that are accessible by standard pickup during the normal operating season. The Forest Service assumes no obligation to plow snow or do special maintenance to keep roads open. Walk-in distances, to the stands, of a mile or more will be encountered.

The area may be closed to motorized vehicle travel during big game hunting season, and the contract access will be subject to the administrative regulations for the area which are in effect at that time.

123 Boundaries

The boundaries of survey areas have been identified by Forest Service on aerial photos.

130 Minimum Requirements of Bidder and Stand Examiner

131 Before a bidder will be considered for award of this invitation, he must meet the following criteria:

a. 1. Completion of a 2 or 4 year course in Forestry Management.

2. Six (6) months of experience in timber cruising, stand examinations, or stocking survey within the 5-year period preceding the advertisement date of this invitation, or

5. List of applicable codes, definitions and directions for completion of cover cards and plot cards. (These are available for review at the Wallowa-Whitman National Forest Headquarters, Baker, Oregon).

6. Plastic flags to designate plot centers.

7. Copy of Stand Examination Procedures.

8. Plastic flagging.

DIVISION 200 - TECHNICAL SPECIFICATIONS

210 Procedures and Standards

For every standard plot taken in each stand, two supplemental plots shall also be taken. The first plot taken in a stand shall be a standard plot followed by two supplenental plots.

STANDARD PLOT: Rquires entries for all items in Division 200.

SUPPLEMENTAL PLOTS: Requires entries for only selected items as designated in Division 200.

211 Stand Examination Instructions

1. Stand examination surveys shall be accomplished by means of variable and fixed area plots. At each plot center, the following type plots shall be measured.

    a. Variable plot will be measured with a Relaskop using a BAF factor of 10.

    b. Fixed area plot of 1/100 acre (11.8 feet radius).

2. Stands will be examined on a systematic grid sample basis. The number of sample plots for each stand to be examined has been predetermined on the basis of a 20% sampling error. No fewer plots than the indicated number for each stand will be acceptable.

3. The Contractor shall determine the spacing distance between standard plots and plot lines. Distance between standard plots will vary between stands as necessary to locate systematically the specified number of standard plots on the plot line. There will be two supplemental plots evenly distributed between each standard plot on a plot line. Plots will be evenly distributed over each stand. The distance between plots and plot lines for any given stand shall be equal unless variance is approved in writing by the COR.

4. Stand examinations plot lines shall be run on cardinal directions and referenced to a photo identifiable point. The reference point shall be marked by the Contractor along the stand boundary or along any of the existing roads shown on the project area map. Azimuth and distance from the point of reference to any one sample plot within the stand is acceptable and will be documented on the aerial photo overlay along with a description of the reference point i.e. species, size, markings. (See Exhibit 8).

5. The location of each stand examination plot will be documented on an aerial photograph overlay will illustrate:

   a. The boundary of the stand.

   b. Location of plots, plot lines, and reference point as in (4) above.

   c. A large scale drawing of the stand illustrating the plot number, azimuth, distance, and route to and between plots. (See Exhibit 8)

6. The Contractor shall locate the starting points for each plot line with plastic flagging furnished by the Forest Service. The distance, azimuth, and the plot number will be written on the flagging. The route to and between plots will be flagged to facilitate relocation for inspection. This route must also be shown on the photo overlay.

7. The first plot on a plot line will be established on one-half the appropriate plot interval from the starting point of the cruise line. Remaining plots on the plot line will be esablished at the designated plot interval as measured from the previous plot by pacing. No plot will be located closer than two chains from the stand boundary or the cleared right-of-way of roads unless approved by the COR.

8. Plot centers will be identified with a wire flag inserted into the soil to a depth of 4" to 8" above ground where practical. Plot number will be written on the flag. Secondary plot markings will consist of ribbon (plastic flagging) wrapped at DBH around two (2) trees opposite of one another with plot center in between the two trees. This secondary marking will be established at right angles to the dirction of travel.

9. When a group of 10 stands are completed, the Contractor will submit the cover cards (#1 and #2), plot cards for the stands, and the photo overlay.

212 Survey Techniques

Hand compass (adjusted to local declination) and pacing methods or their equivalent shall be used to locate plot centers. Aerial photo overlay plot location will be adjusted to reflect photo identification of plot centers. Regardless of the method used, a maximum distance or orientation error of one chain in ten (10) between an occasional pair of plots will be accepted, provided the accumulative total error in that line is less than 4 chains per mile. Error in location of plots, when greater than the aforemntioned limits will make the survey of the stand unsatisfactory, and will require relocation of plots and remeasurement.

213 General Survey Form Instructions - Stand Exam Cover Card Number 1 (Exhibit 1)

A. A separate cover card #1 will be completed for each stand. The following shall be entered for each corresponding large number shown on Exhibit 1.

1. Data to be entered shall be furnished pursuant to Clause 260 (Strata No.)

2. Code 16

3. Refer to Section 160, Stand Listing, for Ranger District codes.

4. Refer to Section 160, Stand Listing, for exam number; which is the stand number.

5. Data to be entered shall be the predominant ecoclass summarized from the individual plot cards.

6. One site tree will be selected and measured within or adjacent to every third plot. A minimum of three site trees are required per stand. Record additional site trees (over 3) on back of cover card #1.

   Each site tree will be measured and recorded by species code, age, and total height. Data shall be recorded pursuant to Clause 215.E.

   Each site tree will be marked with two separate circles of flagging at DBH.

7. through 10. Enter appropriate code from known data.

11. Average Slope. Enter average slope percent from plot cards.

12. Aspect. Enter aspect that is most frequently recorded on plot cards.

214 General Survey Form Instructions - Stand Exam Cover Card - Number 2 - (Exhibit 2)

A. A separate cover card #2 will be completed for each stand.

The following shall be entered for each corresponding large number shown on Exhibit 2.

1. Code 16

2. Refer to Section 160, Stand Listing, for Ranger District codes.

3. Refer to Section 160, Stand Listing, for exam number; which is the stand number.

4. Site Condition. Indicate conditions damaging to the site. Write in comments such as severely burned soil, sheet erosion, gully erosion, severely compacted soil, or evidence of mass soil movement. If no damaging conditions are present, leave blank.

5. Stem Distribution. If stem distribution is generally uniform, leave blank. If distribution is grouped or clumped, enter "G" (Grouped).

   Use "G" when some areas in the stand contain distinctly heavier or lighter stocking than the stand as a whole. Here a statement of average number of trees per acre may be misleading.

6. Examiner. Enter name of Chief of Party of Stand Examination Crew.

7. Remarks. Enter any comments regarding the condition of the stand that may be useful in making silvicultural decisions. These may include observations on soils, insect infestations, disease infection centers, and the general vigor of the stand. Continue on reverse side of card if necessary.

8 through 10. Vegetation Level Occupancy. Three fields, three digits per field. For each of three levels of vegetation in the stand, estimate the percent of ground area covered by the crowns of the vegetation in that level. Each level is considered independently of the other levels and for that reason, a total of three percentages may exceed 100.

11 through 13. Vegetative Dominance. Twelve fields, six digit code per field. This area is designed to provide information on the relative importance of the vegetative species in each of three vegetation levels; trees over 12 feet in height, trees and shrubs less than 12 feet in height and grass forbs. For each level list four species in the order of dominance within the level, with one being most dominant (abundant).

215 General Survey Form Instructions - Stand Exam Plot Card - (Exhibit 3)

A. A separate plot card will be completed for each plot.

B. Both variable and fixed radius plots are taken at all points.

1. Variable radius plot tally - On all plots, record clockwise from north all trees 5.0 inches DBH and larger that fall within the limiting distance of the basal area factor (BAF).

2. Fixed radius plot tally - The fixed radius plots should be measured on the level (horizontal plane) from plot center to center of tree at base. Record trees clockwise from north. Tally as follows: All live trees (saplings) 1.0 inch DBH to 4.99 inches DBH and all line established seedlings. An established seedling is at least 6" in height but no more than 0.99 inch DBH, with good coloration, no evidence of disease, and with root system in contact with mineral soil.

   The appropriate fixed radius plot size is specified in Clause 211.1b (1/100 ac or 11.8 feet radius).

C. Most trees are clearly in or out of the tally count. However, a small percent will be "borderline" trees. Those trees cannot be tallied by the "half tree" system sometimes used in variable plot cruising. Therefore, it should be determined by measurement if the tree is definitely in or out. To determine this, measure the diameter of the tree to the last tenth inch, and refer to the approprite limiting distance table and slope correction table on the tatum aid. If the distance from the point to the geometric center at DBH of the tree (not the face of the tree) in question is greater than the limiting distance, then the tree is out. Down salvageable dead trees are determined to be in or out by measuring the limiting distance to the DBH point on the tree as it lies on the ground. Final determination of an in or out tree is based on limiting distance. Do not record down unsalvageable dead trees of species other than lodgepole.

On the fixed area plot, a tree is considered "in" when the center of the tree at the base is the maximum radius of the appropriate fixed area plot size or less on a horizontal plane.

Record all down mountain pine beetle-killed lodgepole regardless of salvageability.

D. Proper entries to be made in filling out the individual tree data on the stand examination plot card for the corresponding large number shown on Exhibit 3 are as follows:

1. Code 16

2. Refer to Section 160, Stand Listing, for Ranger District codes.

3. Refer to Section 160, Stand Listing, for exam number; which is the stand number.

4. Number consecutively starting over with each stand.

5. Column 1 - Point No. Standard and supplemental plots. Two digit code. Number each sample point consecutively beginning with 01. The point number need only be entered once on the first line used on the point. Do not skip any point numbers. If no trees are present on both the fixed and variable radius plot, enter point number, followed by slope, aspect, and ecoclass.

6. Column 2 - Tree History. Standard and supplemental plots. One digit code. Record for all trees.

   1. - Live Tree

   2. - Salvageable Dead

      Salvageable dead trees are required to have a diameter of 5.0 inches DBH or more, and to have at least 25 percent sound material in them to be recorded as salvable dead. The following table gives the maximum number of radial inches of sapwood rot allowable in a recordable salvable dead tree.

Diameter	Radial Inches Sapwood Rot	Diameter	Radial Inches Sapwood Rot
<12	1.0		
12	2.0	32	7.0
14	2.5	34	7.0
16	3.0	36	8.0
18	4.0	38	8.0
20	4.0	40	8.0
22	5.0	42	9.0
24	5.0	44	9.0
26	6.0	46	10.0
28	6.0	48	10.0
30	6.0	50	11.0

3. - Unmerchantable Dead

Unmerchantable dead trees are required to have a diameter of 5.0 inches DBH or more, and a height of at least 6 feet.

4. Noncommercial Species.

7. Column 3 - Species. Standard and supplemental plots. Three digit code. Record for ALL trees.

COMMERCIAL SPECIES

DOUGLAS-FIR

204 - Douglas-fir

LARCH & CEDAR

073 - Western Larch

TRUE FIRS

015 - White Fir

019 - Sub Alpine

PINES

122 - Ponderosa Pine
108 - Lodgepole Pine
119 - Western White Pine

SPRUCE & HEMLOCK

093 - Englemann Spruce

NONCOMMERCIAL SPECIES

060 - All Juniper

999 All Hardwoods

The above listed species of trees will be the only species recognized as trees within the project. Some other species occasionally attain tree size. However, they are not considered as trees, and will not be tallied as such.

Clumps of trees such as Willow, Dogwood, and Maple, with stems less than 2.0 inches DBH, will be counted as single trees.

8. Column 4 - DBH. Standard and supplemental plots. Diameter will be recorded as a three digit code to the last whole tenth inch for all trees 1.0 inch and larger. Tally seedlings (trees up to 0.9 inch DBH) as 001. A 9.18 inch tree will be recorded 091; a 20.44 inch tree is 204; a 12 inch tall seedling is 001.

Diameters will be measured with a diameter tape at a point 4.5 feet above the ground level or root collar on the uphill side of the tree, except as noted below.

Irregularities at DBH. In the case of irregularities at DBH, such as swellings, bumps, depressions, branches, etc., diameter will be measured immediately above the irregularity at the place where it ceases to affect the normal stem form.

Forked Trees At or Above DBH. If the tree forks at or above 4.5 feet; i.e., crotch of fork is at or above 4.5 feet; consider the tree as one tree and measure the diameter below the swell but as near to 4.5 feet above ground level as possible. Trees of this type will be treated as single trees. Consider only the main fork when making cull deductions and estimates of normal height.

Forked Trees Below DBH. If the stem forks below 4.5 feet, consider the tree as two trees and measure DBH as near to 3 1/2 feet above the fork as possible. Each fork will be considered a tally tree if, on the variable radius plot, the tree is considered an IN tree at the point where DBH is to be measured. Forked trees on the fixed-radius plot are tally trees, if the radius of the plot passes through the center of the tree at ground level.

When two closely spaced trees grow together they sometimes have the appearance of a forked tree. This situation is usually easily recognized because of the seam where the two trees have joined. These trees should be treated as separate trees and recorded as such.

DBH CODES

CODE	DBH RANGE
001 -	Less than 1.0 inches
010 - 019	1.0 - 1.9 inches
020 - 029	2.0 - 2.9 inches
030 - 039	3.0 - 3.9 inches
040 - 049	4.0 - 4.9 inches
050 - 059	5.0 - 5.9 inches
060 - 069	6.0 - 6.9 inches
070 - 079	7.0 - 7.9 inches
etc.	

9. Column 5 - Total Defect. Standard plots only. One digit code. Record for all live trees in the variable radius plots only.

CODE	PERCENT TOTAL DEFECT	
0	No defect	
1	1 - 10	
2	11 - 20	
3	21 - 75	
8 (Sound Cull)	76 - 100	Sweep and crook contributing more than half the volume loss.
9 (Rotten Cull)	76 - 100	Rot and missing parts contributing more than half the volume loss.

CULL TREE INFORMATION

If a tree has conks on bole or limb or ground near its base, it can be assumed that the tree has at least 20 percent cull and total defect should be three or higher. If there is a great deal of rot, it should be checked to see if it has more than 75 percent cull (total defect 9).

The following table is a guide for determining rotten culls (total defect 9).

Rotten Cull (Defect Code 9)

Logs With Rot	No. of 16 Ft. Logs in Tree
First log	2
First 1-1/2 logs	3
First 2 logs	4
First 3 logs	5
First 3-1/2 logs	6
First 4 logs	7
First 4-1/2 logs	8
First 5 logs	9
First 6 logs	10
First 6-1/2 logs	11
First 7 logs	12

If a tree is sound cull because of excessive forking (Damage Code 78) or because of taper or deformity (Damage Code 91), enter 8 in Total Defect.

10. Column 6 - Crown Ratio. Standard plots only. One digit code. Record for ALL live non-cull trees 1 inch or larger if commercial species.

Crown ratio or percent of crown is related to vigor and growth of a tree. Crown ratio is that portion of the tree bole that supports green, live foliage that is effectively contributing to tree growth. Crown ratio is expressed as a percent of total tree height to the nearest 10 percent and recorded as a single digit code.

For trees of uneven crown length, mentally transfer lower branches on the longer side to fill holes in the upper portion until a full, even crown has been generated.

Percent Crown Ratio	Code	Percent Crown Ratio	Code
1-10	1	51-60	6
11-20	2	61-70	7
21-30	3	71-80	8
31-40	4	81-90	9
41-50	5	91-100	0

11. Column 7 - Crown Class. Standard plots only. One digit code. Record for all live non-cull trees 5 inches or larger of commercial species.

Crown class, as used here, is aimed at separating trees that are in a position to grow freely from those that are not, with no further consideration given to size or shape of crown or density of foliage. It is essentially a classification of competition for light.

CODE

1 Open grown	3 Codominant	5 Overtopped
2 Dominant	4 Intermediate	

Codes as defined:

1. Open Grown. Trees with crowns which have received light from above and all sides throughout most of the life of the tree, particularly during the early developmental period, and which have not been and are not likely to be influenced as to form or crown shape by other trees.

2. Dominant. Trees with crown extending above the general level of the crown canopy and receiving full light from above and partly from the side; larger than the average trees in the stand, and with crowns dense, comparatively wide and long, but possibly somewhat crowded on the sides.

3. Codominant. Trees with crowns forming the general level of the crown canopy and receiving full light from above but comparatively little from the sides; usually with medium-size crowns more or less crowded on the sides.

4. Intermediates. Trees shorter than dominants or co-dominants, with crowns below or barely reaching into the main canopy formed by dominant and codominant trees, receiving little direct light from above and none from the sides, usually with small crowns considerably crowded on the sides.

5. Overtopped. Trees with crowns entirely below the general level of the crown canopy, receiving no direct light either from above or from the sides.

In multiple-age stands, or even-aged stands with understory trees of younger age classes, direct application of the above definitions is often difficult. The classification into intermediate and overtopped crown classes is intended to include primarily those trees seriously affected by direct competition with adjacent trees.

As a general rule, in multi-story stands, crown class for each tree must be judged in the context of its immediate environment, that is, those trees affecting it or being affected by it in terms of crown competition. For example, a dominant tree is a tree which generally stands head and shoulders above all other trees in the vicinity. However, there may be a young vigorous tree nearby but not overtopped by a large dominant tree. The smaller tree may be considerably shorter than the dominant tree but still be receiving full light from above and partly from the side. In its own immediate environment it is dominant and should be recorded as such. This situation commonly occurs in East Side multi-storied stands. The same principles apply in two-storied stands. Only understory trees immediately adjacent to the overstory tree will be assigned subordinate crown classes. In cases where the overstory consists of scattered veterans standing above large numbers of younger trees, a considerable portion of the understory trees will be classified as dominant or codominant.

12. Column 8 - Damage Class. Standard and supplement plots. Two digit code. Record for ALL live trees of commercial species. When a tree is damaged by more than one serious agent, record the most severe one.

DAMAGE	CODE
No serious damaging agent	00
INSECTS	
Bark Beetles	11
Defoliators	12
DISEASE	
White pine blister rust	21
Other cankers on main bole	22
Conks on bole, limbs, or ground near tree	23
Other diseases and rot	27
Root rot	28
FIRE DAMAGE	30
ANIMAL DAMAGE (cause unknown)	40
Porcupine damage	41
Big Game damage	42
Livestock damage	43
Rodent damage	44
WEATHER DAMAGE	
Lightning	51
Wind	52
Other	53
Suppressed seedling or sapling	69
OTHER DAMAGE	
Natural mechanical injury	71
Top out, dead or spike top	72
Forked top or multiple stem	73
Deformed top above merchantable height	74
Needles noticeably short and/or sparce or off color	75
Excessive lean-over, 15 degrees from vertical	77
Excessive forking	78
LOGGING AND CONSTRUCTION DAMAGE	CODE
Logging damage	82
Excessive taper or deformity - will not produce a 12 foot conifer log	91
DEAD TREES - STANDING AND DOWN	
Hard snag with cavities or den	92
Hard snag without apparent use	93
Soft snag with cavities or den	94
Soft snag without apparent use	95
Down salvable dead tree with greater than 40 cubic feet gross volume	96
Down salvable dead tree with less than 40 cubic feet gross volme (Does not qualify as wildlife habitat tree.)	97

Application of Damage Codes. As a general rule, make an entry in damage code only when something is wrong with the tree which: (1) Will prevent it from living to maturity, or surviving 10 or more years if already mature: (2) Will prevent it from producing marketable products (straight logs of minimum dimensions or greater); (3) Will reduce or has seriously reduced quality of the tree's products (such as may result from lightning strike, excesssive lean, etc.); or (4) Cause a permanent reduction in growth rate. For the purpose of asigning damage codes, mature will be considered rotation age. Immature trees are those that are less than rotation age. Rotation ages to be used are as follows:

Lodgepole Pine (East and West Sides)	80 years
Hardwoods (East and West Sides)	50 years
All Other Species East Side	140 years

The following are specific guides for use of the damage codes:

Insect Damage. Only serious insect damage will be coded. Nearly any tree in the woods will have insects on it at one time or another, but the mere presence of insects does not necessarily indicate the tree is being seriously damaged. With some insects and tree species, light damage may be a prelude to serious damage and substantial growth impact. Use the following guide in rating insect damage:

GUIDE FOR RATING INSECT DAMAGE FOR CODING IN DAMAGE CODE

Kind of Insect and Host	Light Damage (Do Not Record)	Moderate to Heavy Damage (Record)
Bark Beetles in Douglas-fir		Current Damage. Needles turning yellow or red over most of the tree (tree is dying). Clear or white pitch on bole of tree. Boring dust in bark crevices is conspicuous.
Code 11		Old Damage. Black pitch streak in bark over most of bole.
Bark Beetles in Pine (Ponderosa, Jeffrey, Lodge-Pole, Sugar,	Copious Pitching: pitch tubes large and consisting of yellowish to clear masses of pitch.	Needles turning yellow to red over most of the tree. Small red pitch tubes (less than 1/4 inch in diameter) common.
Western White	No live insects under bark	Reddish boring dust in bark flakes and crevices, or around base of tree. Live insects under bark.
Code 11		
	All Species Except Hemlock and Grand Fir	All Species Except Hemlock and Grand Fir

Defoliators	Entire crown less than 25 percent defoliated.	Entire crown more than 25 percent defoliated.
Dominants, Codominants, and intermediate -- crown classes.	Top third of crown less than 50 percent defoliated or discolored. Leader normal but perhaps short.	Top third of crown more than 50 percent defoliated or discolored. Leader deformed, or killed.
On pines- needle miners, sawflies and pandora moth.	Current foliage with less than 25 percent of tips discolored or less than 25 percent of needles missing.	Current foliage with more than 25 percent of tips discolored or more than 25% needles missing.
On other conifers - budworms, tussock moths, sawflies, pine tip moths, pine needle sheath miners, lodgepole needle miners.	A few branches with no shoot growth	Many branches with no new no new shoot growth.
	Hemlock and Grand Fir	Hemlock and Grand Fir
Code 12	See Moderate to Heavy damage column	Record any degree of defoliator infestation.

Disease Damage

Code 22 - Other Cankers of the Main Bole. Record only when cankers deform the bole, or cause open wounds, or threaten to girdle the tree. Lodgepole pine is often infested with Peridermium harknessii "hip" cankers which sometimes kill the tree.

Code 23 - Conk on bole or limb or ground near base of tree. Use "A Guide for Estimating Decay in the Pacific Northwest" for identifying conks (fungus sporophores), as well as in determining the percent cull caused by the fungus.

Code 27 - Other Diseases and Rot. In immature trees, record any disease which appears to threaten the tree's chances of surviving to maturity or will reduce its quality at maturity because of top-killing, deformity, or decay of bole or serious reduction of tree vigor. In mature trees, record infections which seriously jeopardize the tree's chance of surviving 10 years.

12. Continued

Column 8 - Damage Class, continued

Disease Damage

Examples of other disease and rot are as follows. Indicate specific disease or rot on cover card under "Remarks".

Needle blights, wilts, and rusts
Dry rot associated with sunscalds and mechanical damage
Diebacks.

Fire Damage

Code 30 - Fire Damage. In recording fire damage, ignore basal scars unless they have killed the cambium on half or more of the bole circumference.

In some cases where only the foliage has been killed by fire, do not record fire damage unless the fire-killed foliage reaches into the upper one-third of crown. Ground fires may kill foliage on lower branches without seriously damaging tree.

Animal Damage

Code 40 - Animal Damage (cause unknown). Record animal damage for trees when 1/2 of the bole circumference has been girdled, or when browsing has seriously decimated seedlings or saplings so that they will probably not develop into sound trees.

Code 41 - Porcupine Damage.

Code 42 - Big Game Damage. Includes damage done by deer, elk, bear, etc.

Code 43 - Livestock Damage.

Code 44 - Rodent Damage. Includes mice, rabbits, Mountain beaver, etc.

Code 51, 52, and 53 - Weather Damage. Record only damage which will prevent immature trees from surviving to maturity or will prevent mature trees from surviving 10 years, such as loss of 70 percent of crown to wind or snowbreak, shattering of bole by lightning, partial uprooting by wind, etc.

Code 69 - Live suppressed seedling or sapling. Suppressed understory trees are common in old-growth stands, but may occur in second-growth timber, or even as residual trees after logging. Suppressed seedlings or saplings are usually characterized by extremely short or non-existent internodes, twisted, gnarled stems, short flat crowns of live needles forming "umbrella-shaped" trees or an extreme sparseness of foliage. When in question, cut down a sapling that is off the point and count the rings to see how old it is. Do not include in this category seedlings that would probably respond to release.

Other Damage

Code 71 - Natural mechanical damage. Enter for such things as damage to bole which will reduce the quality of the product at maturity in immature trees or will prevent mature trees from living 10 years. Broken limbs in crown caused by other trees falling into them, or boles half or more girdled by mechanical action such as the rubbing action of trees in the wind, boulders rolling against the bole, etc. are examples.

Code 72 -Top out or top dead (spike top). Record for immature trees. Do not record for mature trees unless more than 10 feet of top is dead or broken out.

Code 73 - Forked top or multiple stem. Ignore small double leaders in mature trees, but record all major forks or multiple stems above merchantable height in immature trees.

Code 74 - Deformed top above merchantable height. In immature trees, enter only when damage will reduce quality of product at maturity. Do not record for mature trees.

Code 75 - Needles or leaves noticeably short and/or sparse or off-color. Ignore minor chlorosis or general "redbelting" of trees due to frost conditions (when the needle tips of trees in a large area are tinged). If defoliators are causing sparseness of foliage, damaging agent should be Code 12, not 75, and if the needles are off-color because of beetle or disease attack and it can be conclusively identified as such, damaging agent will be coded according to the insect or disease attacking tree. If the insect or pathogen cannot be identified, use Code 75.

Code 77 - Excessive lean over 15 degrees from vertical. Record for all trees having this defect regardless of age or size unless a more serious damaging agent is present.

Code 78 - Sound cull forked tree. A hardwood tree that forks within the first 8-foot log or a conifer that forks within the first 12-foot log, the main fork of which forks again within 8 or 12 feet, respectively will go into cull tree class Code 8.

Code 91 - Will not produce a 12-foot log if conifer, or an 8-foot log if a harwood because of taper or deformity. This code will be used for abnormally squatty trees with abnormal taper, or trees which are severely twisted or gnarled. Will go into cull tree class Code 8.

Dead Trees Standing and Down

Code 92 - 97 - Wildlife Habitat Tree Inventory

Wildlife habitat trees are defined as dead trees with value as wildlife habitat in that they furnish opportunities for nesting, denning, perching, roosting, feeding, and cover to to a wide variety of wildlife. They can be either blowndown or standing dead trees and snags.

a. Down salvable dead trees (tree history 02) qualify as wildlife habitat trees if they have at least 40 cubic feet gross volume.

b. Snags qualify as wildlife habitat trees if they are either: (1) standing salvable dead (tree history 02); or 2) standing dead trees not meeting salvable dead requirements (unmerchantable dead) but having a diameter of 11 inches or more and a height of at least 6 feet (tree history 03).

Dead trees and snags are selected by the same variable radius plot methods used for live and blowdown trees.

All snags are classified as either hard or soft according to the following criteria:

Hard Snag - Standing dead tree with majority of the exterior surface visibly sound or not in rotten condition.

Soft Snag - Standing dead tree with majority of the exterior surface in rotten condition.

The following widlife habitat tree instructions will be applied on this contract:

Salvable Dead (Tree History 02) - Applies to all salvable dead. Enter all information in accordance with present field instructions with the exception of Column 8 - Damage Class. Enter one of the following codes there. These are the only acceptable codes for Column 8 and one of them must be used:

CODE	ITEM
92	Hard snag with cavities or den
93	Hard snag without apparent use
94	Soft snag with cavities or den
95	Soft snag without apparent use
96	Down salvable dead tree with greater than 40 cubic feet gross volume (see table below).
97	Down salvable dead tree with less than 40 cubic feet gross volume (Does not qualify as wildlife habitat tree).

40 CUBIC FOOT TABLE

Average Diameter (In.)	Minimum Length (Ft.)	Average Diameter (In.)	Minimum Length (Ft.)
12	50	22	15
14	37	24	13
16	29	26	11
18	23	28	10
20	18	30+	8

Unmerchantable Dead (Tree History 03) - The following items are to be filled in:

COLUMN	DESCRIPTION
1	Point Number
2	Tree History (03)
3	Species
4	Present DBH
8	Damage class (Use Code 92-95 only)
13	Total height of snag

Column 9 - Age Group. Standard plots only. Two digit code. Record for all live non-cull trees of commercial species.

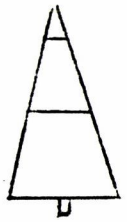
Age Group Years	Code	Age Group Years	Code	Age Group Years	Code
0-1	00	70-79	08	150-159	16
2-9	01	80-89	09	160-169	17
10-19	02	90-99	10	170-179	18
20-29	03	100-109	11	180-189	19
30-39	04	110-119	12	190-199	20
40-49	05	120-129	13	200-300	30
50-59	06	130-139	14	300+	40
60-69	07	140-149	15		

13. Column 10 - Mistletoe Infection. Standard plots only. One digit code. Record for all live trees of commercial species. For trees less than 3 inches DBH, record dwarf mistletoe infection as follows:

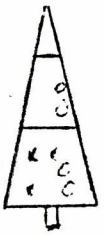
Degree of Infection	Code
No infection	0
Infection in half or less of crown	1
Infection in more than half of crown	2

For tree 3 inches DBH and larger use the following guide:

1. Divide crown in thirds.
2. Score infections in each third as follows:



No Infections	0
Less than 50 percent of the branches infected. No brooms.	1
Fifty (50) percent or more branches infected or one or more brooms, or large infections on main bole (swelling noticeable, bole deformed).	2



3. Add up the score. Enter the total. Example: A tree has no infection in top third of crown, less than half of the branches infected in middle third and more than half of the branches infected in lower third. The total score is 0 + 1 + 2 = 3. Code as 3. 3

14. Column 11 - Point Occupancy. Standard plot only. Two digit code. Record for all live trees 1 inch and larger occurring on the plots. The order of occupancy will be rated as to the trees occupying the greatest amount of growing space. Observe each tree, considering its DBH, crown ratio, and root growing space. The tree which is considered to occupy the largest amount of growing space will be coded 1, the tree occupying the next largest amount of growing space will be coded 2, etc., until all live trees at each point have been rated.

For seedlings, record the total number of seedlings of the same species, damage class, and age group under the point occupancy column.

15. Column 12 - DBH Increment. Standard plots only. Two digit code. Measure the 10-year radial growth from increment cores to the nearest one-twentieth of an inch and record directly in twentieths. For example: Growth for a tree which grew .8 inch radially in the last 10 years is recorded as 16. On level ground, bore the tree at 4-1/2 feet above the ground on the face toward the plot center.

On slopes, bore trees at breast height at a mid-slope location. This will generally be at a point below the height where DBH is measured.

Sample Tree Growth sample trees are the first (moving from 0° azimuth) trees which fit each of these diameter and species categories:

The first tree 5" - 8.9" DBH of each species.
The first tree 9" - 14.9" DBH of each species.
The first tree over 15" DBH of each species.
The largest tree over 15" DBH of each species.
The best tree 3" - 4.9" on the fixed plot.

16. Column 13 - Tree Height. Standard plot only. Three digit code. A total tree height must be entered for each tree 5 inches DBH and larger.

Measure the total height to the nearest foot of each tree measured for growth increment.

17. Column 14 - Phloem Thickness. Standard plots in Strata 1 and 2 stand only. Measure the phloem thickness on the LLP which are also measured for radial growth. Phloem thickness at breast height (not total bark thickness) is measured to the nearest 0.01 inch. Excise two (2) bark samples from opposite sides of the tree. Using a steel ruler, measure the phloem thickness from each sample; average these measures and enter the average on the plot card.

18. For each plot, the percent of slope for the area in the vicinity of the plot should be shown on the bottom of the plot card.

19. For each plot, the direction the slope faces for the major portion of the area as N, NE, E, SE, S, etc. or as F for Flat or R for Rolling, should be shown on the bottom of the plot card.

20. Enter initials of person doing stand exam.

21. Enter date stand exam performed.

22. For each plot, record the four most significant ground vegetation species observed on the plot and their percent ground cover for trees and shrubs less than 12 feet and grass and forbs. Standard four or five letter scientific name abbreviations will be furnished pursuant to Clause 150.

23. Enter ecoclass of the area in the vicinity of the plot.

E. Site tree data to be collected pursuant to Clause 213.A.6.

1. Site trees will be dominant trees of the predominant species, without defect or disease, free from suppression and without damage which would affect height growth.

2. CAUTION: Use only one species per stand. When possible, avoid using trees less than 30 years old.

3. If possible, the site tree will be one of the trees tallied on the plot, and identified with an asterisk (*) in column one (1) of the plot card. Actual age for site tree shall be entered in the left hand margin of the plot card.

4. If there are no suitable site trees on the plot, select one in close proximity to the plot, and record the azimuth and distance from plot center to the tree, and species code, age, and total tree height on the back of the plot card.

5. Age cores for all site trees will be left at the tree by placing the core between the tree and the band of flagging. Age cores will be extracted at DBH using same criteria for level and slopes specified for DBH increment (215.D.16). Ten (10) years shall be added to the age of DBH to arrive at the total age of the site tree.

6. Each site tree will be marked with two separate circles of white flagging at DBH.

220 SURVEY DATA

221 All completed stand examination plot cards and cover cards shall become the property of the Government prior to payment.

DIVISION 300 - INSPECTION AND ACCEPTANCE

310 - Compliance Inspection

The COR or Inspector may, by formal inspection, determine if the specified standards of work have been accomplished. Failure to meet specified standards shall require prompt corrective action. Repeated failure to meet specified standards of work may be cause for termination of the contractor's right to proceed and the contract considered in default.

320 - Inspection Procedure

321 Stand examination work will be accepted on the basis of formal inspection by the COR or his designated Inspector.

322 Plots will be inspected to determine if the standard of work has been met. A minimum of 10 percent of all plots and/or 10 percent of the stands will be inspected. This will constitute a minimum inspection for determining satisfactory performance.

323 Wherever administratively practical, inspections will be done weekly as the survey progresses.

324 The contractor shall make all current stand examination forms available to the COR or Inspector.

330 - Determination of Acceptable Work

331 Each stand inspected, the inspector will examine the stand and record on "stand exam cover cards 1 and 2" his finding on those items requiring data enteries in Clauses 213 and 214.

332 At each inspection plot the inspector will examine the plot area and record on "stand examination card" his finding on those items requiring data enteries in Clause 215.

333 The data enteries required in Clauses 213, 214, and 215 will be allowed to vary in accordance with the tolerances shown on the "Tolerance and Error Tables" (Exhibit 4, 5, and 6).

334 The total number of incorrect trees as determined from the tolerance and error tables divided by the total number of trees tallied on the inspection will determine the percentage of unsatisfactory work. One hundred percent (100%) minus percentage unsatisfactory work equals percent satisfactory work. Each line entry of seedlings on plot cards will be counted as one tree when calculating the percentage of satisfactory work.

335 Acceptble work includes a neat and readable presentation of field data on plot cards in good condition using correct and complete coding. Coding errors found in the editing process will be subject to contractor correction prior to payment for satisfactory work.

Strata #1 Cheantmoon District

Random #	Photo #	T. and R.	Section	Stand Acreage	Primary * Plots per stand	Grid in Sq. Chains	Species	Comp. Name and #	Location
2	12-158	T.1N R.50E	5	40	10	6	M-D LP	Wing #3005	F-4
4	12-156,158	" "	8	280	50	8	M-D LP I-D WF	" "	F-5
6	12-156	" "	8	20	8	5	M-D LP I-WF P	" "	F-5
8	12-156	" "	17	30	8	6	M-LP WF	" "	F-6
10	12-156	" "	17	30	8	6	M-WLLP I-WF	" "	F-6
12	12-20	" R.49E	13	70	14	7	M-LP I-WF ES	" "	D-6
14	12-20	" "	13	30	8	6	M-LP I-WF D	" "	D-6
16	12-73	" "	23	80	16	7	M-LP WF I-WF D	Sour #3705	C-3
18	12-73	" "	23	30	8	6	M-LP WF I-WF ES	" "	C-3
20	12-22	" "	24	140	22	8	M-WF LP I-WF WL	" "	D-3
22	12-22	" "	25	160	26	8	M-LP I WF ES	" "	E-4
24	12-23	" "	35	70	14	7	M-LP I WF ES	" "	C-5
26	12-23	" "	36	20	8	5	M-LP WF I-WL WF	" "	D-5
28	12-23	" "	36	30	8	6	M-LP WF	" "	D-5
30	12-24	T.1S R.49E	1	160	26	8	M-LP I-WF ES	" "	D-6
36	12-25	" "	1	90	17	7	M-LP I-WF DF	Lightning #3706	D-3
38	12-25	" "	1	50	10	7	M-WF LP I-WF ES	" "	D-3
32	12-69	" "	2	200	34	8	M-LP I-WF ES	" "	C-3
34	12-25	" "	2	70	14	7	M-LP WF I-WF ES	" "	C-3
40	12-67	" "	10	280	50	8	M-LP WF I-WF	" "	B-4
42	12-66	" "	15	170	18	8	M-LP WF I-WF ES	" "	B-5
44	12-66	" "	15	100	18	7	M-LP WF I-WF	" "	B-5
46	12-28	" "	14	320	38	10	M-LP I-WF ES	" "	C-5
48	12-29	" "	23	110	18	8	M-LP I-WF ES	" "	C-6
50	12-65	" "	22	120	19	8	M-LP WF I-WF	" "	B-6
52	12-64	" "	21	180	30	8	M-LP AF I-AF	Granny #3708	C-1
60	10-101	" "	28	50	10	7	M-WF LP I-WF	" "	C-2
58	12-63	" "	27	70	14	7	M-LP AF I-AF	" "	D-2
56	10-101	" "	27	160	26	8	M-LP AF I-AF	" "	D-2
54	12-64	" "	26	50	10	7	M-LP WF I-WF ES	" "	E-2

* In Strata #1 no supplementary plots will be taken.

Strata #2 LaGrande and Baker Districts

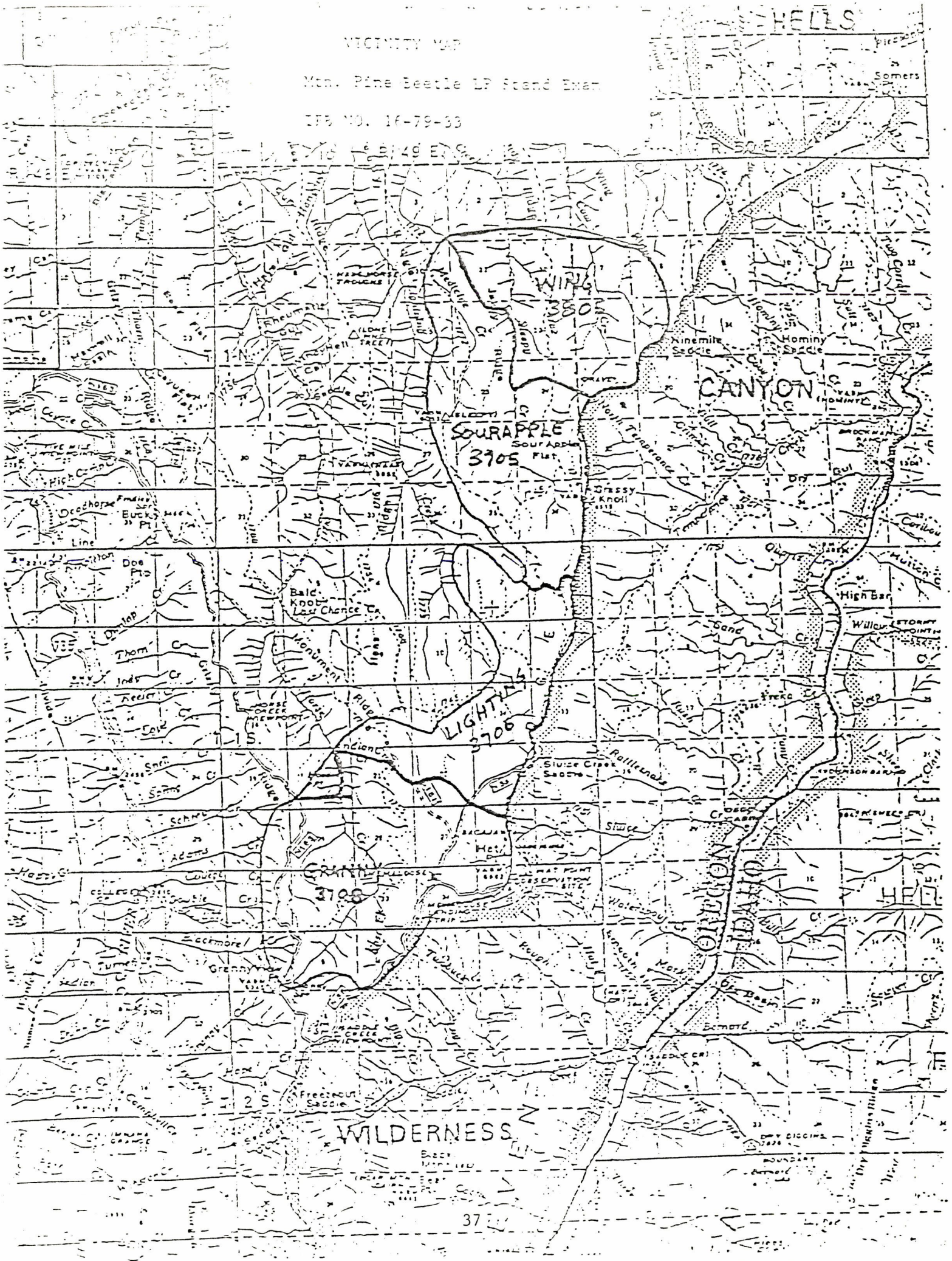
Random #	Photo #	T. and R.		Section	Stand Acreage	Primary** Plots per stand	Grid In Sq. Chains	Species	Comp. Name and #	Location
6	7-124 7-58	T.3S	R.33E	23	330	60	9	M-LP DF I-P DF	Gibson #6301	C-2
10	6-142	T.2S	R.34E	32	20	8	5	M-LP I-WF WL	Coy #6206	F-2
19	3-146	T.5S	R.37E	16	30	8	6	M-LP	Dan #6803	D-4
14	3-48	T.4S	R.37E	26	80	16	7	M-LP I-DF P	Whiskey #6804	E-2
18	3-15	T.4S	R.37E	31	40	10	6	M-LP WF	Dan #6803	B-1
1	6-44	T.5S	R.34E	26	200	46	8	M-LP WL I-LP	Squawk #6404	D-2
3	9-41	T.5S	R.35E	9	30	8	6	M-LP I-WF P	Johnson #6502	A-2
4	8-177	T.5S	R.35E	9	90	17	7	M-LP I-WF WL	" "	C-2
5	8-94	T.5S	R.35E	13	30	8	6	M-LP I-DF WF	" "	E-3
2	1-85	T.5S	R.36E	9	50	10	7	M-LP DF	North #6702	D-2
13	3-50	T.5S	R.37E	1	50	10	7	M-LP I-DF WF	Howard #6805	B-3
21	3-30	T.5S	R.37E	20	80	16	7	M-LP WL I-WL WF	Hauner #6801	B-3
22	3-53	T.5S	R.37E	22	20	8	5	M-LP WL	" "	D-3
20	3-53	T.5S	R.37E	23	70	14	7	M-LP	Dan #6803	F-5
23	6-47 9-176	T.6S	R.35E	9	100	18	7	M-LP WF I-LP WF	Little #6405	C-4
15	9-37	T.6S	R.35E	3	60	12	7	M-LP I-WF	Tony #6503	E-4
9	9-35	T.6S	R.35E	12	30	8	6	M-LP I-LP	Coyote #6406	E-2
7	9-172	T.6S	R.35E	28	200	34	8	M-LP I-P D	" "	B-5
8	9-172	T.6S	R.35E	27	340	62	9	M-LP DF I-DF	" "	C-5
12	9-170	T.6S	R.35E	33	70	8	5	M-LP I-D WF	Chicken #6504	D-5
16	2-20	T.6S	R.36E	24	60	12	7	M-LP I-DF WL	Aurelia #6604	D-2
11	1-95 1-234	T.6S	R.36E	27	180	8	5	M-LP WF I-DF WF	Penny #6601	C-4
27	8-78	T.7S	R.35-1/2E	36	10	6	4	M-LP I-WL WF	Cabel #1705	B-2
17	1-231	T.7S	R.36E	10	30	8	6	M-ES LP I-WF	Aurelia #6604	B-6
24	1-100	T.7S	R.36E	16	60	12	7	M-LP I-WF	Badger #1703	B-2
25	2-26	T.7S	R.36E	24	20	8	5	M-AF LP	Badger #1703	E-3
28	8-75	T.8S	R.35-1/2E	1	210	36	8	M-LP WL I-LP WF	Cabel #1705	B-3
29	8-73	T.8S	R.35-1/2E	12	60	12	7	M-LP WF I-WL WF	Cabel #1705	B-4-5
30	8-69	T.9S	R.35-1/2E	2	10	6	4	M-LP WF I-WF DF	Cougar #1601	B-5
26	2-44	T.9S	R.36E	35	20	8	5	M-LP WF I-WF DF	Buck #1301	B-5

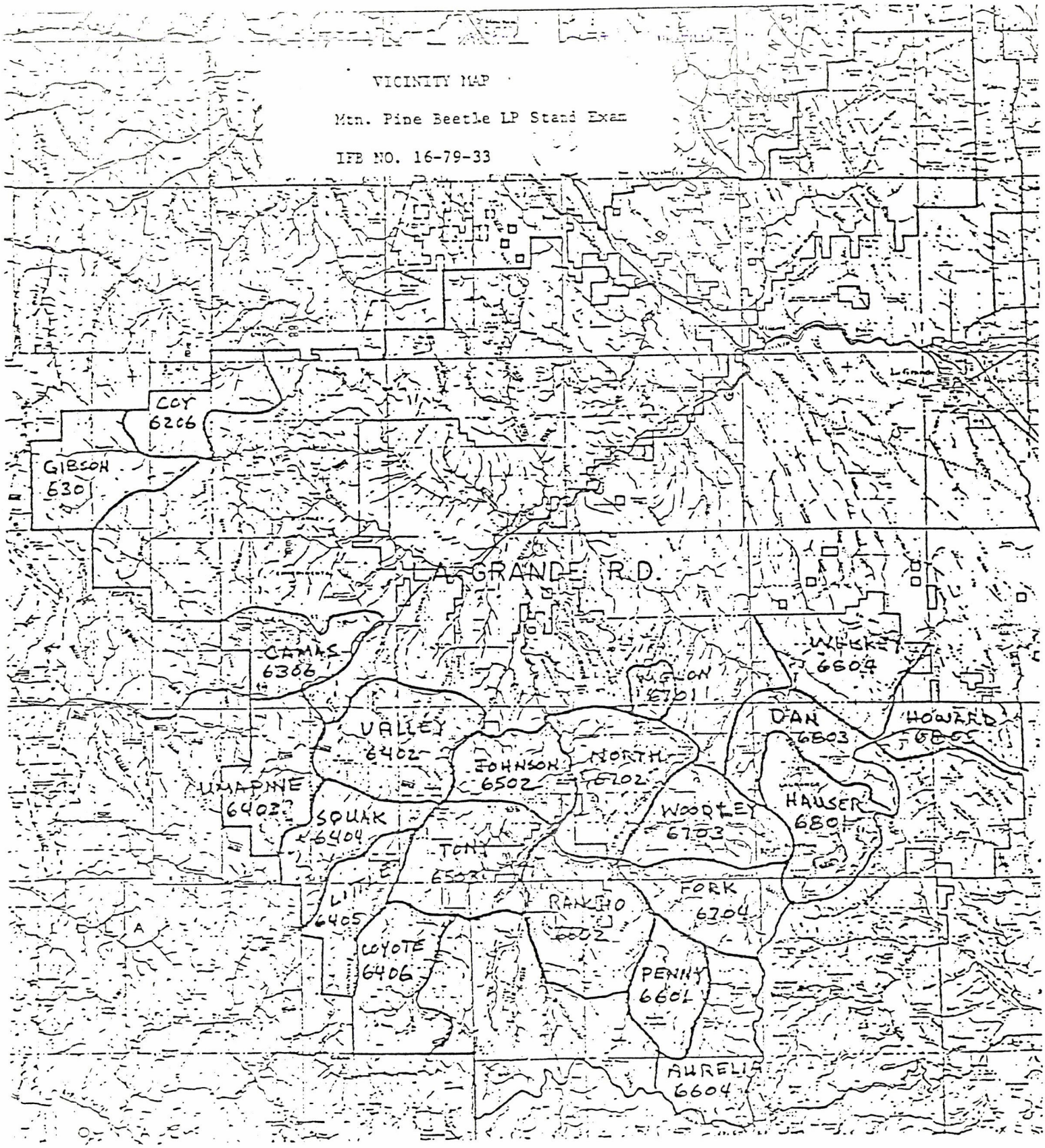
Note: Baker District compartments -- all others LaGrande District
** 2 additional supplementary plots will be installed between two stand exam plot where possible.

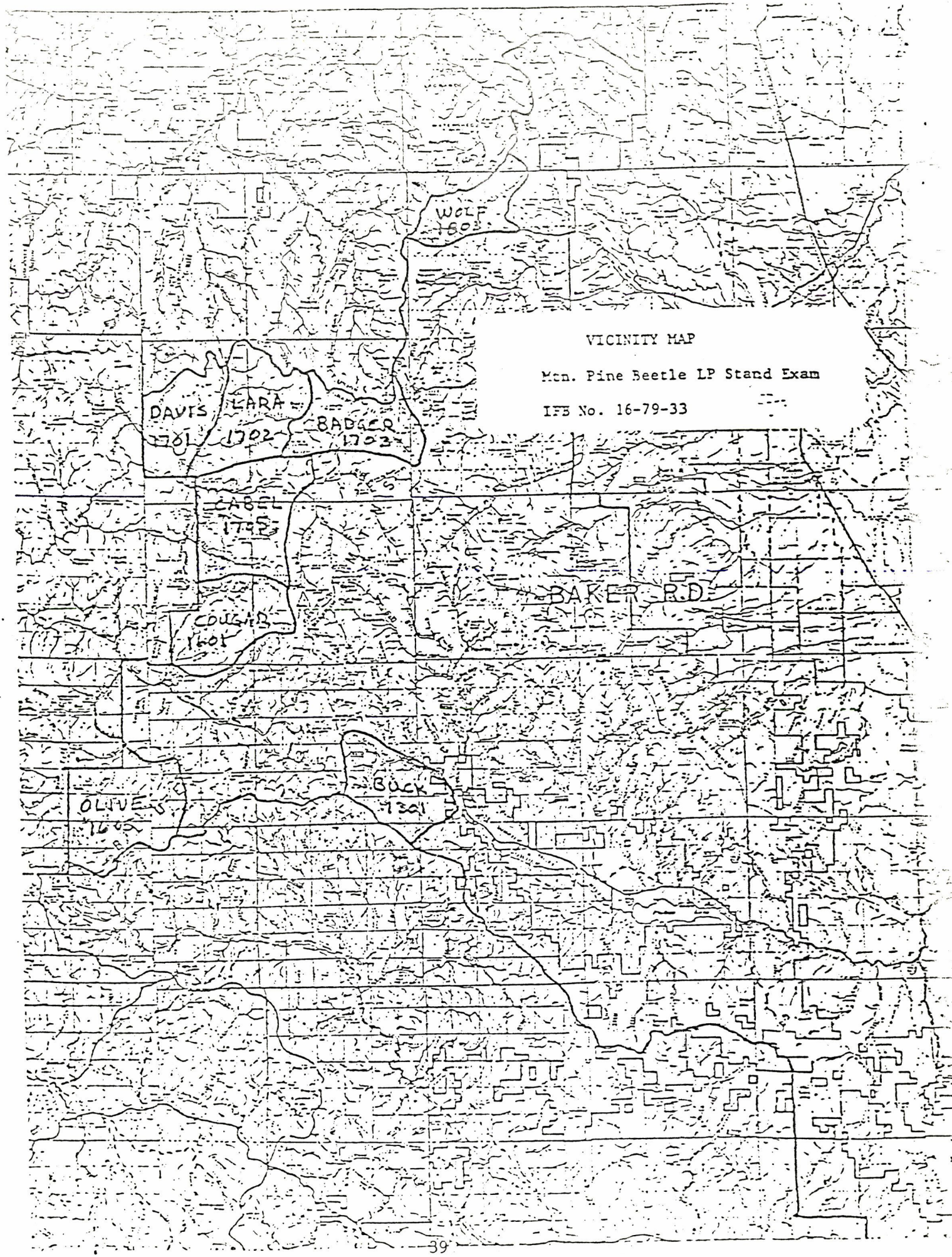
Strata #1 - LaGrande and Baker Districts

Random #	Photo #	T. and R.		Section	Stand Acreage	Primary AA Plots per stand	Grid In Ft. Chains	Species	Comp. Name and #	Location
4	6-154	T.6S	R.34E	32	90	17	7	M-LP P I-P	Caman #6306	B-4
12	6-173	"	"	28	100	18	7	M-LP I-WL	" "	C-3
19	1-82	"	R.36E	33	10	6	4	M-LP I-WL WF	Malon #6701	D-5
20	6-2	T.5S	R.34E	12	80	16	7	M-LP WF I-LP WF	Valley #6402	C-4
5	6-150	"	"	18	80	16	7	M-LP I-WL WF	Umapine #6403	A-5
21	9-95	"	R.35E	17	80	16	7	M-P LP I-WF	Valley #6402	E-5
30	6-42	"	R.34E	15	70	14	7	M-LP	Squawk #6404	C-1
17	9-177	"	"	35	50	10	7	M-LP WL I-LP	Little #6405	C-2
8	9-97	"	R.35E	29	100	30	8	M-LP WL I-WF DF	Tony #6503	C-2
3	8-94	"	R.36E	18	40	10	6	M-LP WL	North #6702	B-3
28	1-85	"	"	15	80	16	7	M-LP WL I-WF WL	Woodley #6703	C-2
29	2-11	"	"	13	30	8	6	M-LP I-D WL	" "	E-2
1	1-242	"	"	23	30	8	6	M-LP I-D WF	" "	D-3
2	2-11	"	"	24	220	38	8	M-D LP	" "	E-3
27	1-63	"	"	32	10	6	4	M-LP I-D LP	" "	A-5
13	1-63	"	"	32	40	10	6	M-LP DF I-DF P	Fork #6704	A-1
18	6-40	T.6S	R.35E	17	90	17	7	M-LP I-LP	Little #6405	B-5
9	8-182	"	"	3	120	19	8	M-LP WF I-WF DF	Tony #6503	E-4
14	1-91	"	R.36E	3	80	16	7	M-LP WF I-WF DF	Fork #6704	C-2
15	1-238	"	"	40	40	10	6	M-LP I-WL DF	" "	C-3
7	1-59	"	"	10	200	34	8	M-LP I-WF	Rancho #6602	C-5
16	1-91	"	"	14	130	20	8	M-LP I-WL DF	Fork #6704	D-4
6	1-234	"	"	27	30	8	6	M-LP WF I-WF DF	Penny #6601	C-4
10	2-20	"	"	25	20	8	5	M-LP WL	Aurelia #6604	D-3
26	3-26	"	R.37E	8	30	8	6	M-LP WL I-WL WF	Wolf #1803	B-3
22	8-189	T.7S	R.35-1/2E	10	140	22	8	M-LP I-DF WF	Davis #1701	B-2
23	8-80	"	"	14	210	36	8	M-LP I-D	" "	C-3
24	8-79	"	"	24	560	80	9	M-LP I-WL	Lara #1702	C-5
11	1-231	"	R.36E	3	170	28	8	M-LP WF I-WC LP	Aurelia #6604	B-5
25	8-205	T.9S	R.35-1/2E	22	40	10	6	M-LP WL I-DF P	Olive #1605	E-1

Note: Baker District compartments -- all others LaGrande District
** 2 additional supplementary plots will be installed between two stand exam plot where possible.


VICINITY MAP
Mem. Pine Beetle IP Stand Exam
IPS NO. 1F-79-33
T. 2 S., R. 4 E.
HELLS
Somers
WIRE
SOURAPPLE
3705
Sour Apple Flat
Grassy Knoll
Ninemile Saddle
Hominy Saddle
CANYON
North Temperance
Deadhorse
Buck's
Line
Doe Flat
Bald Knoll
Last Chance Cr.
Monument
Thom
Jnds
Ridge
LIGHTNING
3706
Indian Cr.
Sluice Creek
Saddle
Rattlesnake
High Bar
Willow
Sand
Stormy Point
Hole-in-the-Wall
Granny
3708
Eccmore
Freezeout Saddle
WILDERNESS
IDAHO
OREGON
15
2 S
1 E


VICINITY MAP
Mtn. Pine Beetle LP Stand Exam
IFB NO. 16-79-33
COY
6206
GIBSON
630
LA GRANDE R.D.
CAMAS
6306
VALLEY
6402
JOHNSON
6502
NORTH
6702
UMAPINE
6403
SQUAK
6404
TONY
6503
WOODLEY
6703
HAUSER
680
DAN
6803
HOWARD
6805
WHISKEY
6604
RANCHO
6602
FORK
6704
COYOTE
6406
PENNY
6601
AURELIA
6604



VICINITY MAP

Mtn. Pine Beetle LP Stand Exam

IFB No. 16-79-33

EXHIBIT #1

USDA - Forest Service

STAND EXAMINATION COVER CARD #1

TYC SYSTEM IDENTIFICATION

3. Call Nos. _____
4. X-Ref. Compt. Names _____
5. X-Ref. Nos. _____
6. X-Ref. Call Nos. _____
7. Posting Record
   Period Examined _____
   Accomp. Rptd. _____
   Posted _____
   Microfilmed _____
8. Area Location 1 _____

CARD TYPE II DATA (OPTIONAL) (2)

1. Form Class Data (2-41)

	Species	FC		Species	FC
(1)			(5)		
(2)			(6)		
(3)			(7)		
(4)			(8)		

2. Minimum Top DIB (42) ____
3. Log Length (43) ____

CARD TYPE I DATA (1)

1. Compartment Name (2-20) _____
2. Compartment No. (21-25) _____
9. Forest No. (26-27) 2
10. Ranger Dist. No. (28-29) 3
11. Exam. No. (30-32) 4
12. Midpoint Elevation (33-36) _____
13. Ecoclass 5
    Formation (37-38) _____
    Series (39-40) _____
    Community (41-42) _____
14. Site Tree Data 6

Species	Age	Height

15. Site Index (43-44) _____
16. Site Index Species (45-47) _____
17. Stocking Level Curve
    Species (48-50) _____
    Site Class (51) _____
18. BAF (52-53) 7 _____
19. Fixed Area Plot (54-56) 8 1/ _____
20. No. of Points (57-58) 9 _____
21. Sample Kind (59) _____
22. Crop Age Group (60-61) _____
23. Exam. Date Mo. Yr. (62-65) 10 _____
24. Volume Calculation Method (66) _____

Form R6-2410-212 (5/74) GPO 994-427 (FSH 2409.26d)

25. Average Slope (67-68) 11
26. Aspect (69-70) 12

EXHIBIT #2

USDA Forest Service

STAND EXAMINATION COVER CARD #2

FOREST NO. 1 (XX) RANGER DIST. NO. 2 (XX) EXAM. NO. 3 (XXX)

AREA CONDITION DATA	VEGETATION DATA		
	Percent Cover Each Level (XXX)	Dominance	Species of Vegetation (XXXXXX)
1. Percent Slope			
2. Exposure			
3. Site Condition 4			
	Trees > 12' 8	1	
		2	11
		3	
4. Fuel Type		4	
	TR – SHB < 12' 9	1	
		2	12
5. Stem Distribution 5		3	
		4	
6. Examiner 6	Grass & Forbs 10	1	
		2	13
		3	
		4	

7. Remarks 7

Form R6-2410-314 (5/74) GPO 981-069 (FSH 2409.26d)

EXHIBIT #3

USDA - Forest Service

FRONT SIDE

STAND EXAMINATION PLOT CARD

Forest 1 (2-3) Ranger Dist. No. 2 (4-5) Exam. No. 3 (6-8) Card No. 4

*	*	*	*				*					
1	2	3	4	5	6	7	8	9	10	11	12	13
Point Number	Tree History	Species	DBH	Total Defect	Crown Ratio	Crown Class	Damage Class	Age Group	Mistletoe Rating	Point Occupancy	DBH Increment	Total Height
XX	X	XXX	XXX	X	X	X	XX	XX	X	XX	XX	XXX
5	6	7	8	9	10	11	12	13	14	15	16	17

Phloem Thickness XX 18

*Supplemental plot data

% of Slope 19 Aspect 20

FORM FS 2410-313 (Rev. 3-74) FSH 2409.26d

Initial of Examiner 21

Date of Examination 22

EXHIBIT 4.3 (4)

PROJECT SITE

STAND EXAMINATION PLOT CARD

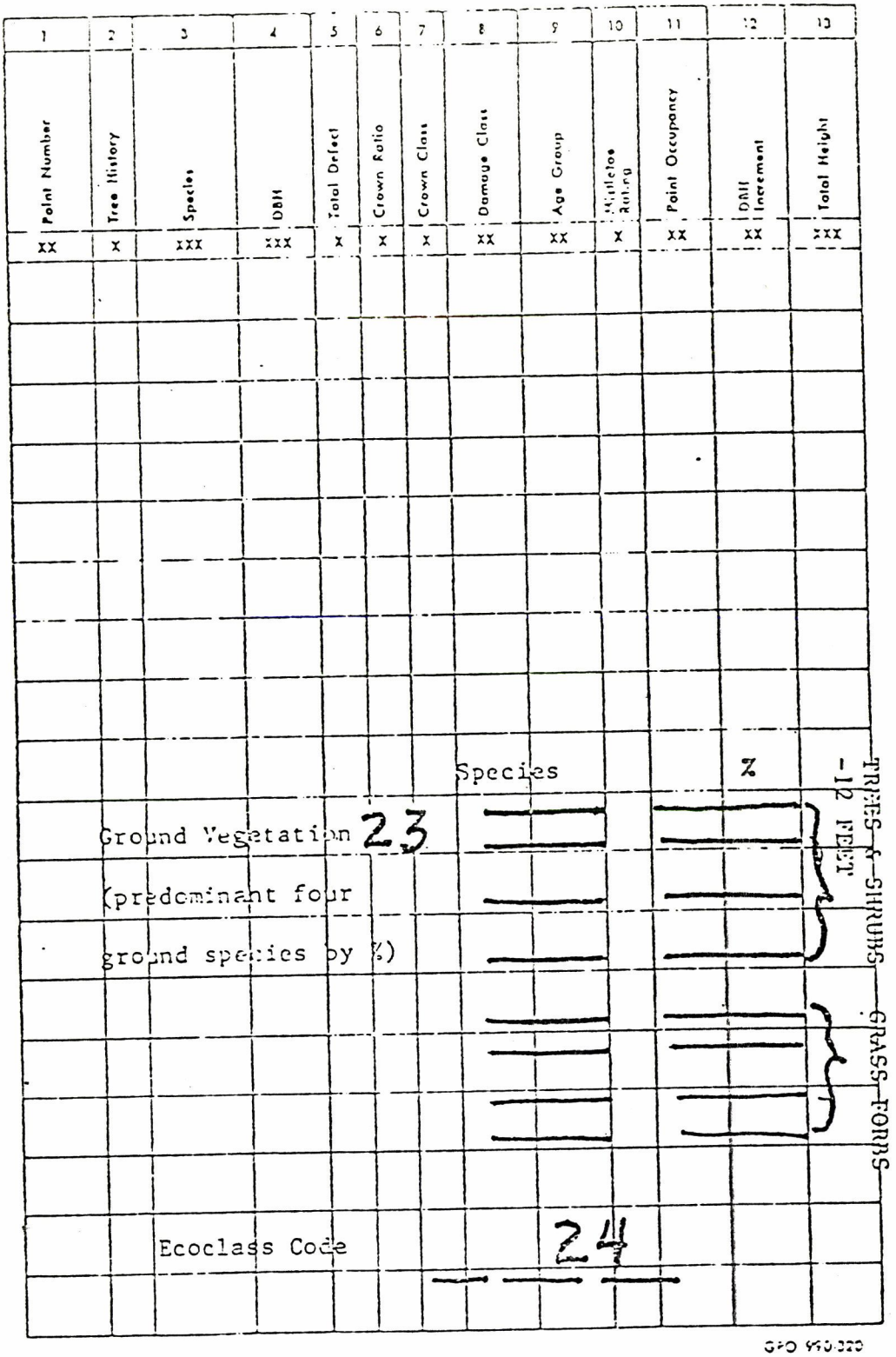


EXHIBIT 4

TOLERANCE AND ERROR TABLE

USDA - Forest Service

RIAMI EXAMINATION COVER CARD #1

TRI SYSTEM IDENTIFICATION	CARD TYPE I DATA (1)
3. Cell No.	1. Compartment Name (2-20)
4. X-Ref. Compt. Name	2. Compartment No. (21-25)
5. X-Ref. No.	9. Forest No. (26-27)
6. X-Ref. Cell No.	10. Ranger Dist. No. (28-29)
7. Posting Record	11. Exam. No. (30-32)
Period Examined	12. Midpoint Elevation (33-36)
Accomp. Rptd.	13. Ecoclass
Posted	Formation (37-38)
Microfilmed	Series (39-40)
8. Area Location	Community (41-42)
	14. Site Tree Data
	Species / Age / Height
	15. Site Index (43-44)
	16. Site Index Species (45-47)
	17. Stocking Level Curve
	Species (48-50)
	Site Class (51)
	18. BAF (52-53)
	19. Fixed Area Plot (54-56) 1/
	20. No. of Points (57-58)
	21. Sample Kind (59)
	22. Crop Age Group (60-61)
	23. Exam. Date Mo. Yr. (62-65)
	24. Volume Calculation Method (66)

CARD TYPE II DATA (OPTIONAL) (2)

1. Form Class Data (7-41)

Species	FC	Species	FC
(1)		(5)	
(2)		(6)	
(3)		(7)	
(4)		(8)	

2. Minimum Top DIB (42)
3. Log Length (43)

Form R6-2410-312 (5/74) GPO 994-427 (FSH 2409.26d)

Data will be subject to inspection in accordance with clause 335

EXHIBIT 5

USDA Forest Service

STAND EXAMINATION COVER CARD #2

FOREST NO. _____ (XX) RANGER DIST. NO. _____ (XX) EXAM. NO. _____ (XXX)

AREA CONDITION DATA	VEGETATION DATA
1. Percent Slope	Percent Cover Each Level (XXX) / Dominance / Species of Vegetation (XXXXXX)
2. Exposure	Trees > 12' — 1, 2, 3, 4
3. Site Condition	TR – SHB < 12' — 1, 2, 3, 4
4. Fuel Type	Grass & Forbs — 1, 2, 3, 4
5. Stem Distribution	
6. Examiner	
7. Remarks	

Any two errors in Area Condition Data will result in 1 incorrect tree.

One or more errors in Vegetation Data will result in 1 incorrect tree.

Form R6-2410-314 (5/74) GPO 991-068 (FSH 2409.26d)

EXHIBIT 6

USDA - Forest Service

STAND EXAMINATION PLOT CARD

Forest _____ (2-3) Ranger Dist. No. _____ (4-5) Exam. No. _____ (6-8) Card No. _____

TOLERANCE AND ERROR TABLE

1	2	3	4	5	6	7	8	9	10	11	12	13
Point Number	Tree History	Species	DBH (Inches from actual measurement)	Total Defect	Crown Ratio	Crown Class	Damage Class	Age Group	Mistletoe Rating	Point Occupancy	(D) DBH Increment & (P) Phloem Thickness	Total Height
xx	x	xxx	xxx	x	x	x	xx	xx	x	xx	xx	xxx
											± .04 = P	
TOLERANCES												
0	0	0	*	±1	±1	±1	0	±1	±2	**	±2=D	***
Any error will result in one incorrect tree				Any error will result in one-fifth incorrect tree.								

In addition, any tree larger than a seedling, incorrectly tallied will result in 1 incorrect tree. Any error in the seedling count of 20% or more of the inspection count will result in one incorrect tree. ****For each seedling line entry, one inspection tree will be counted.

SITE TREE	Species	Choice	Age	Height		
TOLERANCE	0	0	±5	±5 ft.		
	Any error in Species and Choice will result in one incorrect tree. All others, any one error will result in one-half incorrect tree					

	TOLERANCES	
SLOPE(Percent)	±10	Any error will result
ASPECT	±45°	in one-half incorrect tree
GROUND VEGETATION	0	

PERCENT OF SATISFACTORY WORK

$$\frac{\text{Total Number Incorrect Trees}}{\text{Total Number trees on Inspection}} \times 100 = Y$$

100-Y = Percent of satisfactory work

* DBH - ± 0.2" tolerance allowed for trees larger than 5 inches DBH
0.1 tolerance allowed for trees less than 5 inches DBH

** Point Occupancy ± 1 tolerance allowed on variable radius plot
± 2 tolerance allowed on fixed radius plot

*** Total Height ± 10% or 10 feet whichever is less except for site trees.

**** Example: + or - 1 seedling for 4 to 7 seedling count; + or - 2 seedlings for 8 to 10 seedling count. Maximum of 1 incorrect tree for each line entry.

EXHIBIT

TIMBER STAND ELIMINATION INSPECTION SUMMARY (New)

STAND NUMBER											
NUMBER OF PLOTS TAKEN											
NO. TREES PER PLOT											
PLOT NUMBERS INSPECTED											
DATE OF INSPECTION											
TOTAL INCORRECT TREES											
TOTAL INSPECTED TREES											
UNSATISFACTORY PLOTS NO PAYMENT											

NUMBER OF MISSED TREES

NUMBER OF INCORRECT TREES (as determined from inspection in Clauses 331 and 332 and in accordance with tolerance and error tables Exhibits 4, 5, and 6.)

NUMBER OF INSPECTED TREES

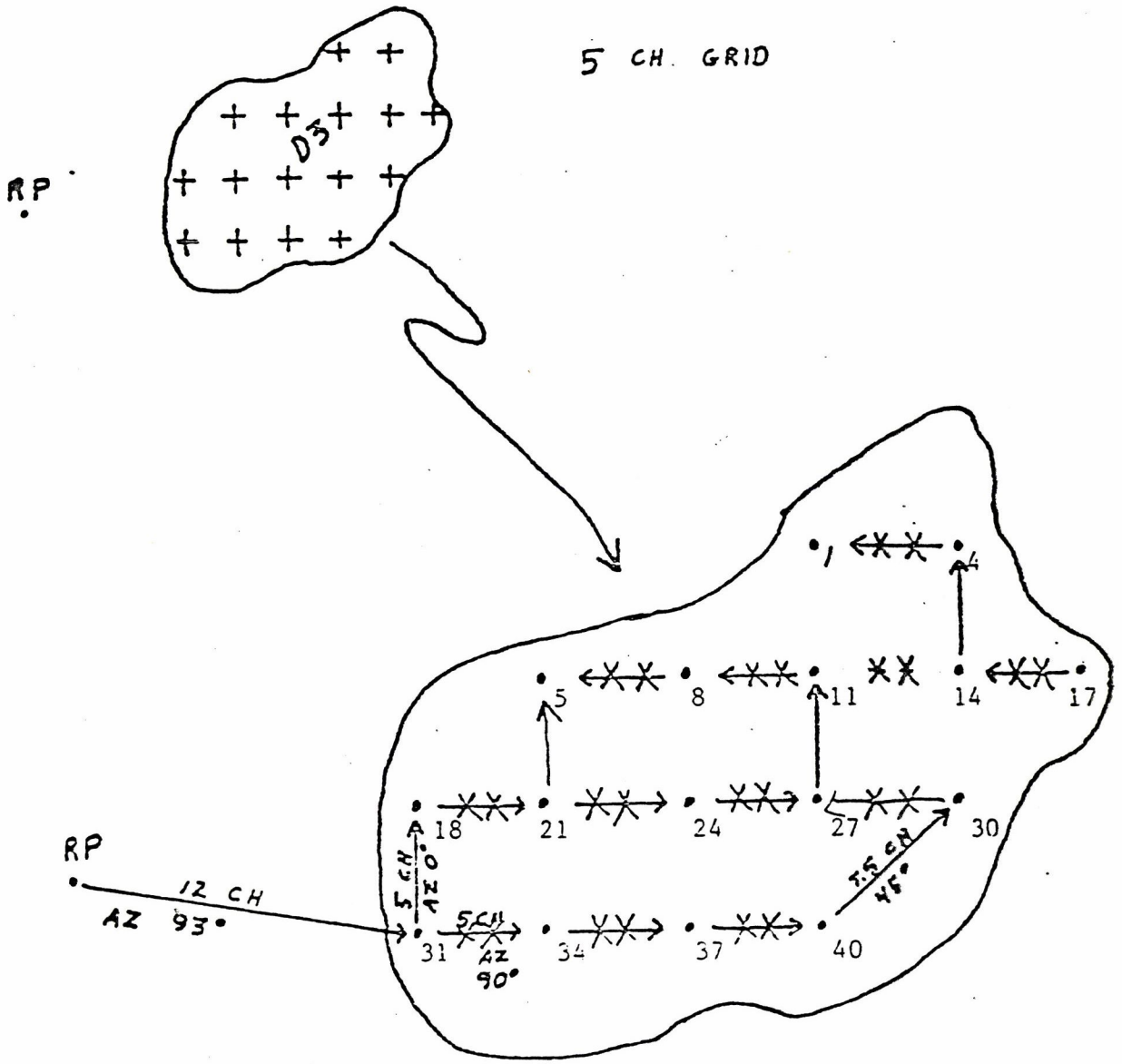
PERCENT SATISFACTORY

ITEM	TOTAL NUMBER OF ERRORS	ITEM	TOTAL NUMBER OF ERRORS
TREE HISTORY		SITE TREE, SPECIES	
SPECIES		CHOICE	
DBH		AGE	
TOTAL DEFECT		HEIGHT	
CROWN RATIO			
CROWN CLASS			
DAMAGE CLASS		FUEL TYPE, SPREAD	
AGE GROUP		CONTROL	
MISTLETOE		VEGETATION DATA	
POINT OCCUPANCY		OTHER	
DBH INCREMENT			

SAMPLE OVERLAY

STAND 066

PHOTO NO.
0372 196



• = standard plots

X = supplemental plots

Exhibit 9

TREE TALLY GUIDE

Standard Plots

1	2	3	4	5	6	7	8	9	10	11	12	13
Tree Class or Site	Tree History	Species	DBH	Tree Defect	Crown Ratio	Crown Class	Damage Class	Age Group	Merchantability	Pole Commercial	Non-Commercial / Pole-Commercial	Tree Height 2/
XX	X	XXX	XXX	X	X	X	XX	XX	X	XX	XX	XXX
		Live Trees - Commercial Spp.										
Seedlings	1	X	001				X	X	X	V		
Saplings	1	X	X		X		X	X	X	X	X / X	X
Poles & Sawtimber	1	X	X	X	X	X	X	X	X	X	X / X	X
		Cull Trees - Commercial Spp.										
All	1	X	X	9			X		X	X	X / X	X
		Dead Trees - Commercial Spp.										
All except seedlings	2	X	X				92-97				X /	X
All except seedlings	3	X	X				92-95				X /	X
		Non Commercial Spp.										
All	4	X	X							X		
V	No. of seedlings of the same spp., damage class & age group											

2/ The first tree 5" - 8.9" DBH of each species.
The first tree 9" - 14.9" DBH of each species.
The first tree over 15" DBH of each species.
The largest tree over 15" DBH of each species.
The best tree 3" - 4.9" on the fixed plot.

GPO 990-370

Supplemental Plots

1	2	3	4	5	6	7	8	9	10	11	12	13
Tree Class or Site	Tree History	Species	DBH	Tree Defect	Crown Ratio	Crown Class	Damage Class	Age Group	Merchantability	Pole Commercial	DBH Tree	Tree Height
XX	X	XXX	XXX	X	X	X	XX	XX	X	XX	XX	XXX
		Live Trees - Commercial Spp.										
Seedlings	1	X	001				X					
Saplings	1	X	X				X					
Poles & Sawtimber	1	X	X				X					
		Cull Trees - Commercial Spp.										
All	1	X	X				X					
		Dead Trees - Commercial Spp.										
All except seedlings	2	X	X				92-97					
"	3	X	X				92-95					X
		Non Commercial Spp.										
All	4	X	X									

GPO 990-370

Cost Factors

A. Survey Preparation

Work plan and project planning	GS-12 @ $120	30 Days	$3,600
Phase I, Map transcription of TRI stand data	GS-3 @ $40	20 Days	$ 800
Phase II. Aerial reconnaissance			
Flying time			
Survey recon.	15 hours $45	$675	
Ferry	8 hours	$360	$1,035
Salaries and p.d.			
GS-12 $120	6 days	$720	
GS-11 $ 90	6 days	$540	
Per diem	4 days (2)($35)	$280	$1,540
Phase III. Stand transfer	GS-3 $40	20 days	$ 800
Ortho-photo quadrangle maps			$1,600
		Subtotal	$9,375

Contributed by FIDM $4,800

B. Training and data collection

Ground survey

Salary			
Project leader	GS-12 $120	10 Days	$1,200
Forest mensurationist	GS-12 $100	15 days	$1,500
Forester	GS- 9 $75	20 days	$1,500
Per diem			
Project leader	10 days	$35	$ 350
Forest mensurationist	5 days	$35	$ 175
Forester	5 days	$35	$ 175
Miscellaneous photos and supplies			$ 300
Contract survey of approximately 1,600 stand exam plots and 3,200 MPB mortality plots			$40,000
		Subtotal	$54,575

Contributed by FIDM and Wallowa-Whitman NF $2,700

C. Data Preparation (keypunch and verify) $ 3,500

D. Data Analysis
-stand prognosis and MPB outbreak model (computer programming, (analysis, and documentation):

INT	$ 6,500
MAG	$ 3,000
FI&DM	$ 1,500

-Region 6 VPLOT analysis and analysis using Timber Management programs for model comparisons:

FI&DM	$ 1,000
MAG	$ 3,000

-R-6's FCC computer use: $ 1,000

Subtotal $19,500

E. Publication

Salaries

GS-12 $120/day	30 days	$ 3,600
GS-11 $90/day	20 days	$ 1,800

Illustrations $ 500

Text $ 1,000

Subtotal $ 6,900

Contributed by FIDM and MAG $7,200

Total $80,975

Total contributed by all cooperators $13,050

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